

CHAPTER 10

CONFINED SPACE ENTRY PROGRAM

10-1. Purpose. The purpose of the Confined Space Entry (CSE) Program is to eliminate or significantly reduce hazards associated with the entrance into confined spaces. The atmosphere in a confined space may be extremely hazardous because of the lack of natural air movement. This characteristic of confined spaces can result in oxygen deficient atmospheres, flammable atmospheres, and/or toxic atmospheres. The Confined Space Entry Program is accomplished through the services of specially qualified personnel and involves administrative, educational, and technical procedures.

10.2. References. 29 CFR 1910.146, Permit-required confined spaces.

10-3. Definitions. See glossary for a list of related definitions.

10-4. Responsibilities.

a. The Safety Manager shall establish and conduct a complete and comprehensive Confined Space Entry (CSE) Program to meet the purpose, intent, and mandatory requirements and direct the following actions:

(1) Appoint a Confined Space Entry Manager (CSEM) and ensure this person meets the requirements for certification.

(2) Authorize the initial and recurring formal training required for the Confined Space Entry Manager, Assistant Confined Space Entry Manager (ACSEM), Confined Space Entry Technician (CSET) and other personnel to administer an effective CSE program.

b. The Confined Space Entry Manager (CSEM) shall:

(1) Establish and administer the CSE program as required in this regulation. Regardless of position in command structure, the CSEM is directly responsible to both the Commanding Officer and Civilian Executive Assistant (CEA) for all aspects of the CSE program.

(2) Establish procedures for confined space testing, treatment, and certification prior to entry or work.

(3) Ensure that the necessary equipment, in sufficient quantities to meet the requirements of the depot CSE operation, is procured, maintained, and calibrated.

(4) Ensure that all CSE personnel are properly trained, qualified, and certified. CSE personnel must know what personal protective clothing and equipment (PPCE) is required in relevant emergency procedures.

(5) Ensure that all personnel that work in or have employees that work in confined spaces are trained and aware of the hazards of confined spaces. Coordinate required training between the CSEM and directorate/activity commands.

(6) Test and evaluate confined or enclosed spaces and prepare, issue, and post CSE permits for these spaces, indicating either safe or

unsafe conditions and specify control measures required for the space occupancy and operations.

(7) Establish requirements and procedures for cleaning, ventilating, inerting, pressing-up, or other treatments which may be used in confined or enclosed spaces.

(8) Monitor operations and ensure that proper procedures are followed prior to commencement of, during, and after hot work in, on, or adjacent to confined/enclosed spaces. Monitor welding operations to ensure compliance with requirements.

(9) Monitor operations to determine that personnel do not perform hazardous work in confined/enclosed spaces alone or unobserved.

(10) Monitor operations and ensure that procedures are established for emergency rescue and medical treatment and appropriate personnel are familiar and trained in rescue procedures.

(11) Establish standard operating procedures to stop work and evacuate personnel from a space or location in the event an unsafe condition relating to CSE is detected or suspected.

(12) Ensure that the appropriate directorate/activity head is notified when any hazardous situation is detected which causes work stoppage and/or personnel evacuation.

(13) Ensure that CSE records are maintained for a minimum of one year.

c. Assistant Confined Space Entry Manager (ACSEM). The specific duties of the ACSEM shall be the same as those of the CSEM except that such duties shall be performed under the technical supervision of the CSEM. The ACSEM shall meet the same education, experience, and training requirements for certification as the CSEM and shall be equally qualified to perform CSE services. He/she shall function organizationally as assistant to the CSEM in the management and administration of the activity program and serve as CSEM during the absence of the CSEM.

d. Confined Space Entry Technician (CSET). Personnel shall be designated as CSETs to perform limited CSE functions during the absence of the CSEM and ACSEM, i.e., after regular working hours, and on weekends. The CSEM, after consulting appropriate directorate/activity heads shall determine the number of CSETs required to support this program. CSETs may test and certify spaces as "Safe for Entry". If a hazardous or oxygen deficient atmosphere is indicated, the CSEM or ACSEM shall be notified. These personnel shall be listed on the depot recall roster. The CSET shall:

(1) Test confined or enclosed spaces as required by this regulation and as directed by the CSEM.

(2) Ensure that confined or enclosed space certificates are correctly issued, posted, maintained, updated and properly observed.

(3) Stop work and require all personnel to evacuate a confined or

enclosed space when an unsafe condition relating to CSE is detected or suspected. Immediately notify the CSEM and the job supervisor.

(4) Properly use and maintain required test equipment.

(5) Ensure that emergency safety precautions and procedures are appropriate to, and adequate for, the nature of the operation. This includes the presence of required personnel and equipment, availability of medical aid and personnel familiar with the established rescue procedures.

(6) Ensure that personnel do not work alone or unobserved in a confined or enclosed space.

(7) Perform record keeping duties as prescribed by the CSEM.

e. The Safety Office will issue and control Confined Space and "Hot Work" permits as required by TYAD regulation 420-3.

f. Directors/Division Chiefs shall:

(1) Establish procedures to ensure that no space under their control which has been identified as a confined space is entered until evaluated by CSE personnel.

(2) Require that personnel, military or civilian, and supervisors required to work in confined spaces receive training.

g. Supervisors shall:

(1) Notify the CSEM to schedule CSE testing prior to entry into any space which may contain a toxic or oxygen deficient atmosphere.

(2) Notify the Fire Department prior to performing "Hot Work" as required in TYAD Regulation 420-3.

(3) Arrange for portable ventilation or other equipment (i.e., protective clothing and equipment, harnesses, lanyards, safety lines, winch or rescue equipment, radio equipment, etc.) as specified by CSE personnel.

h. All personnel shall:

(1) Refrain from entering any posted confined space or any area which may contain a flammable, toxic, oxygen enriched, or oxygen deficient atmosphere until evaluated by CSE personnel.

(2) Comply with all instructions of CSE personnel when working in or around confined spaces.

(3) Notify CSE personnel of any suspected hazardous conditions related to confined spaces at any building, structure, or area. If there is a possibility that the condition may involve flammable, reactive material or toxic vapors, promptly notify the Fire Department.

(4) Entrants shall wear the protective clothing specified by the CSEM or ACSEM.

10-5. Posting of Signs.

a. Entrances to all readily accessible confined spaces shall be posted as necessary to prevent unauthorized, inadvertent, or unsafe entries. Placement of signs should be determined during the confined space inventory. Signs for these areas should contain the following information:

DANGER
CONFINED SPACE
ENTRY BY PERMIT ONLY
CONTACT SAFETY OFFICE, CONFINED SPACE ENTRY MANAGER
EXTENSION 57027

b. Ensure that signs with the following legend or equivalent are posted near the entrance of all tanks, boilers, or other confined areas or spaces that may contain toxic or oxygen deficient atmospheres:

PRIOR TO ENTRY,
CONTACT THE CONFINED SPACE ENTRY MANAGER
AT THE SAFETY OFFICE
EXTENSION 57027

c. To prevent unauthorized or inadvertent entries into any confined space where work is in progress, the area should be posted as warranted until the operations have been completed. These signs should include the following information.

CAUTION
CONFINED SPACE
WORK IN PROGRESS
DO NOT ENTER WITHOUT PROPER AUTHORIZATION

10-6. Procedures.

a. No person shall enter any space which may contain less than 20% oxygen or more than 22% oxygen, or which may contain toxic or explosive gases above 10% of the Lower Explosive Limit (LEL), dusts, or vapors, until the CSEM has inspected and tested the area and certified that the hazardous atmosphere has been reduced to an acceptable level.

b. All confined spaces shall be assumed "UNSAFE" until determined "SAFE" and the appropriate entry certificate or tag posted at the confined space entrance. If the space is determined "UNSAFE", entry shall be prohibited until precautions prescribed by the CSEM are initiated.

c. Certification shall not be for more than 1 work shift or exceed 8 hours, unless authorized by the CSEM or ACSEM.

d. A lifeline and, if needed, a self-contained breathing apparatus (SCBA) or supplied air respirator with an escape breathing air source shall be worn by trained personnel as prescribed by the CSEM. An observer, shall be positioned at the scene.

The observer must be trained, equipped, and prepared to assist the worker from the confined space in the event of an emergency.

UNDER NO CIRCUMSTANCES SHALL AN UNPROTECTED, UNTRAINED PERSON ENTER A SPACE TO ATTEMPT TO RESCUE A PERSON WHO MAY BE OVERCOME FOR ANY REASON. RESCUE UNDER THESE CONDITIONS SHALL NOT BE ATTEMPTED EXCEPT BY THE FIRE DEPARTMENT OR TRAINED PERSONNEL.

e. "Inerting" shall be done only in emergency situations and shall be supervised by the CSEM.

f. The CSEM shall supervise all "Pressing-up" operations and all "Hot Work" on or near containers, which hold gasoline or other highly volatile material.

g. Fuel tanks shall be cleaned when practicable.

h. The CSEM has the authority to order anyone out of an area or to suspend operations immediately if an "UNSAFE" condition is suspected. He/she shall promptly notify the Commanding Officer/CEA of any work stoppage and the reason for such action.

i. The CSEM is authorized access into all spaces within this depot for the purpose of performing official duties.

j. To arrange for CSE services, contact the CSEM at the Safety Office.

(1) Arrangements for routine CSE services after regular work hours or on weekends or holidays shall be made with the CSEM at least 8 hours in advance.

(2) Emergency CSE services may be initiated by calling the Security Division.

10-7. Emergency and Rescue Procedures. Emergency and rescue procedures, in order to be most effective, must be planned consistent with the nature of the operations and the conditions within the confined or enclosed space. When personnel are entering and working in confined or enclosed space, emergency and rescue plans and procedures shall incorporate the following requirements:

a. An emergency/rescue control point shall be established at a location suitable to supply emergency rescue assistance within a reasonable period of time. The location must be carefully evaluated dependent upon the nature and conditions of the operation and the space. In some cases, it may be necessary to locate the rescue control point immediately adjacent to the space such as emergency entries into the spaces which are immediately dangerous to life or health (IDLH). In other cases, a centrally located control point may serve a wide area involving multiple confined or enclosed spaces. Fire Department and/or Health Clinic response teams may also serve as rescue control points.

b. Emergency/rescue control points shall be manned with an adequate number of trained and qualified personnel to enable rescue of personnel from confined or enclosed spaces.

c. Rescue personnel entering a space to attempt rescue shall be equipped with a NIOSH approved pressure-demand self-contained breathing apparatus, harness and lifeline and any other personal protective equipment applicable to the conditions.

d. Attendant personnel shall be thoroughly instructed that rescue attempts involving entry shall not be made before the rescue control point has been notified and assistance has arrived. Rescue efforts by means of the lifeline shall be attempted until assistance arrives.

e. All personnel involved in confined or enclosed space entry and/or work shall be trained in the proper procedures to follow for rescue efforts. They shall be informed of the rescue control point and the means of notifying them in the event of an emergency.

f. Medical services and treatment shall be readily available for personnel overcome or injured in confined or enclosed space incidents. Location of medical facilities and means of communications will be incorporated into confined/enclosed space emergency and rescue plans.

10-8. Contractor Operations.

a. The contractor, when performing operations shall provide a qualified person as required in 29 CFR 1910.146 for Confined Spaces.

b. CSE services shall not be provided for contractor personnel except in emergencies. Contractor permit person shall meet the requirements set forth in the OSHA Standard for Confined Space Entry, prior to entry into confined spaces on this depot.

c. The appropriate laws and regulations make no provision for Federal CSE personnel to perform CSE for contractor operations. Performance of such functions may involve assumption of liability by the Army in the event of a mishap. Therefore, Federal CSE personnel shall not certify spaces for contractor operations or personnel except where failure to do so would create an extreme emergency and would endanger personnel and property, and may therefore, create even greater liability. Such cases must normally be authorized by the Commander and shall normally be personally conducted and supervised by the CSEM, except where the nature of the emergency is so extreme that delays created by seeking the Commander's approval or the personal services of the CSEM would create a greater danger.

d. Where depot personnel and contractor personnel are to occupy the same space for a given task or operation, the space in question shall be tested and certified by the depot CSEM in accordance with the requirements of this manual and the appropriate contractor representatives shall be so informed. However, such testing, certification, and subsequent notification shall in no way relieve the contractor of any pertinent statutory obligations for the safety and health of contractor personnel and the contractor shall be so informed.

10-9. Administrative and Record Keeping Requirements.

a. The Confined Space Entry Permit, SIOTY Form 48, shall be maintained for all tests and inspections of confined or enclosed spaces

required by the provisions of this manual.

b. Records Retention. All confined space entry logs and permits shall be maintained by the activity for a period of one year from the date of the last log entry or the date of the permit.

10-10. Evaluation of Confined Space Hazards. Many factors must be evaluated prior to entry into, or work in or on, a confined or enclosed space. Such evaluations shall include, but not necessarily be limited to the following considerations:

a. The contents and/or previous contents of the space which may result in the presence of flammable, toxic, or oxygen depleted or enriched atmospheres.

b. The location and configuration of the space including restricted access, obstructions, remoteness, etc., which may inhibit or interfere with movement, ventilation, rescue efforts, or fire fighting efforts.

c. The types of operations which are conducted within the space, particularly those which by the very nature of the process produce toxic materials, oxygen depletion or enrichment, or ignition.

d. Fixtures, devices, or equipment within or next to spaces which may create or contribute to hazardous conditions including piping systems, conduits, ducts, machinery, or pressurized lines; for example, welding next to a vent pipe system that contains fuel needs to be checked prior to the welding operation.

e. The presence of other hazards such as slippery surfaces, deteriorated or unstable ladders, irritant or caustic materials, etc.

f. The boundary spaces and their contents to ensure that fire or explosion will not be caused in these spaces by the operation to be conducted.

10-11. Classification of Confined or Enclosed Spaces. Confined or enclosed spaces include those with open tops, but with a depth or configuration sufficient to restrict the natural movement of air, and those which are normally closed with limited or restricted openings for entry and exit. Open spaces include areas such as mixers, dip tanks, sewage treatment facilities, pits, trenches, and certain types of storage tanks. Closed spaces include fuel tanks, chemical holding tanks, silos, sewers, utility tunnels, boilers, condensers, voids, and similar spaces. All manholes on Tobyhanna Army Depot, for steam, condensate return, electrical, water or waste lines are to be considered permit required confined spaces and must be tested prior to entry. Confined or enclosed spaces are classified based on existing or potential hazards as follows:

a. Class I Space. A space which contains atmospheres or conditions which are, or which may reasonably be expected to become, immediately dangerous to life or health (IDLH). Such conditions include the presence of flammable vapors at a concentration of 10% or greater of the lower flammable/explosive limit, oxygen content less than 16% or greater than 22%, the presence of toxic materials which exceed a level from which a person could escape within 30 minutes without impairing symptoms or

irreversible health effects, or any combination of these conditions.

b. Class II Space. A confined or enclosed space which contains atmospheres or conditions which are, or may reasonably be expected to, become dangerous, but are not immediately life threatening. Such conditions include the presence of flammable, flammable atmospheres in concentrations at or greater than 1% but less than 10% of the lower flammable/explosive limit, oxygen levels greater than 16% but less than 20% or greater than 21% but less than 22%, contaminants at concentrations below levels which are IDLH but at or above established permissible exposure limits or any combinations of such conditions.

c. Class III Space. A confined or enclosed space which contains atmospheres or conditions which are, or may reasonably be expected to become, contaminated; but not to a level which is dangerous or immediately life threatening. Such conditions include the presence or flammable atmospheres in concentrations less than 1% of the lower explosive limit (LEL), oxygen levels consistent with outside ambient conditions (20% or 21%), toxins at concentrations below Permissible Exposure Limits (PEL) or any combination of such conditions, and the prescribed conditions for flammable, oxygen, and contaminants can be reliably and consistently maintained.

d. Class IV Space. A space which contains no flammable or contaminants, has an oxygen level between 20% to 21%, and presents little potential for generation of hazardous conditions as described in paragraphs a, b, or c above.

NOTE: The oxygen content levels expressed in Class I, II, III, And IV spaces are approximate percentages. It must be recognized that minor deviations may occur due to atmospheric pressure, instrument accuracy, etc. The oxygen content of atmospheres in confined or enclosed spaces should be as close as possible to that contained in the outside air. Oxygen shall not be added to a confined or enclosed space to elevate the percentage of oxygen within the space. Ventilation should be utilized to achieve an oxygen level within the space, which is consistent with that of the outside atmosphere.

10-12. Entry/work Restrictions for Class I and Class II Spaces. The following restrictions apply to entry and work in or on Class I and Class II confined or enclosed spaces.

a. Class I Spaces. Entry into and work in or on Class I spaces shall not be permitted under normal operations and is authorized only under the following circumstances:

(1) Entry into Class I spaces is authorized only in cases of extreme emergency such as rescue efforts, and emergency repairs. In the event of any such emergency entry or work, personnel entering the space shall be equipped with a National Institute of Occupational Safety and Health (NIOSH) approved positive pressure demand self-contained breathing apparatus with escape provision, a harness of a type suitable to permit extraction of the person from the space, a lifeline securely attached to the harness, and such other necessary personal protective equipment suitable to the conditions and exposure. Emergency rescue personnel,

equipped with the above listed equipment, and any additional equipment which may be necessary to effect a rescue shall be stationed immediately outside the entry to the confined or enclosed space. Communications shall be established and maintained between the person entering the space and attendant personnel outside the space. Where flammable or explosive vapors, gases or materials are present, only approved explosion-proof, spark-proof, or intrinsically safe equipment and tools shall be used.

(2) Cold work may be performed on the external areas of a Class I space, from outside the space, provided that the work performed does not generate heat or other ignition sources which may cause ignition of atmospheres within the space.

(3) Hot work may be performed on the external areas of a Class I space from outside the space, when the atmosphere inside the space does not contain flammable, explosive, or oxygen enriched atmosphere. The Class I classification of the space, in this case, would be based on oxygen depletion or the presence of contaminants, and would include spaces which are inerted, pressed up or a combination thereof.

b. Class II Spaces.

(1) Flammable, toxic gases, or deviations of oxygen levels within a space may be due to the materials and conditions within the space, or may be created by the operations conducted in the space. Where the contaminations are caused by materials or conditions within the space, the cause or source of the contamination shall be identified and removed to the maximum degree possible by cleaning, ventilating, or other such treatments prior to entry or work.

(2) Where operations are conducted which introduce flammable, toxic vapors, or oxygen deviations within the space (spray finishing, welding, cutting, solvent cleaning, etc.) the following restrictions shall be observed:

(a) Where toxic or flammable materials are or may be introduced into the space, general, dilution, and/or local exhaust ventilation or a combination thereof shall be introduced.

(b) Where toxic materials are or may be introduced into the space, personnel within the space shall be provided with NIOSH approved respiratory protective equipment suitable for the exposure.

(c) Where flammable gases or vapors are or may be introduced into the space, approved explosion-proof, spark-proof, or intrinsically safe equipment, tools, and clothing shall be used and all potential ignition sources shall be closely controlled.

c. When contaminating operations such as spray finishing, welding, solvent cleaning, etc., are to be conducted within a confined or enclosed space, the certificate shall specify the requirements applicable to the operations, such as ventilation, personal protective equipment (PPE), respiratory protection, explosion-proof/spark-proof equipment, etc.

d. Personnel shall not work alone and without communication or observation in a confined or enclosed space. Communications between personnel outside the space and personnel entering or working in a confined or enclosed space shall be established and maintained. The type of communication (voice, signal line, etc.) and the frequency of contact (continuous, periodic check, etc.) shall be determined by the CSEM, based on the nature of the space, operations and degree of hazard.

10-13. Testing Procedures for Confined/Enclosed Spaces.

a. Testing and Examination. The following provisions shall be incorporated into test and examination procedures:

(1) Initial testing shall be performed from outside the space. Testing into the interior of the space may be performed by drop tests or insertion of sample probes and hoses into the space.

(2) Tests for oxygen content shall be conducted first utilizing an approved oxygen meter. Oxygen level should be approximately 21%. Oxygen levels less than 20% or greater than 22% represent potentially dangerous situations.

(3) Test for combustible vapors with an approved combustible gas indicator: Many safety standards require that combustible atmospheres be maintained at or below 10% of the lower explosive/flammable limit. However, due to the many variables involved with testing instruments and the frequent inability to obtain finite readings, any reading observed on the combustible gas test instrument should be considered as evidence of potentially unsafe conditions. NOTE: Many combustible gas indicators presently available function by indicating a circuit imbalance created by the combustion within the meter of samples taken. Proper oxygen levels must be present in the sample for combustion to occur within the instrument. Combustible gas indicators, which operate on this principle, will not function correctly in sampling atmospheres which are oxygen deficient or enriched. Therefore, oxygen tests should be conducted prior to conducting combustible gas tests to avoid false or misleading readings on the combustible gas indicator.

(4) Tests for the presence of specific toxic hazards is dependent upon the nature of the space and its contents or previous contents.

(5) When initial tests indicate the presence of hazardous concentrations of flammable, toxic gases or deviations in oxygen levels, personnel shall not enter the space. The space shall be ventilated and/or cleaned to remove flammable and toxic atmospheres and provide proper oxygen levels.

(6) When significant work interruptions occur such as breaks, lunch periods, etc., and operations and/or conditions are such that in the judgement of the CSEM a deterioration of safe conditions within the space could occur, the space shall be retested and/or inspected after the work interruption and prior to resuming entry and/or work in the space.

(7) When initial tests do not indicate the presence of hazardous concentration of flammable or contaminants or deviations from normal oxygen levels, the space shall be entered and tests as in para. 2, 3, and 4 shall be performed progressively throughout the space. If these tests indicate

the presence of hazardous concentrations of flammable or deviation from normal oxygen levels the tester shall exit and the space shall be ventilated.

(8) If tests throughout the space do not indicate the presence of hazardous concentration of flammable or contaminants or deviations from normal oxygen levels, the space will be inspected for the presence of flammable or combustible (or toxic where applicable) residues, blisters or scale which may trap hazardous substances, rags, rope, wood and other materials which may become dangerous upon application of heat. Additionally, any specific structure equipment or location which may be affected by the intended work should be tested and or inspected as applicable.

(9) Where appropriate cleaning and/or ventilation fails to remove hazardous concentrations of contaminants or flammable from a space, or where it is possible that such conditions may be encountered, such as flammable or toxic vapors trapped in sludge blankets which can be released when the blanket is disturbed, and it is necessary for personnel to enter the space to conduct further confined space entry testing, inspections, evaluations, etc., such entries shall be subject to the following restrictions.

(a) All entries into spaces which contain hazardous concentrations of contaminants or flammable must be specifically authorized by the CSEM.

(b) Personnel entering spaces shall be equipped with a NIOSH approved positive pressure, pressure demand, supplied air respiratory protection, safety clothing and equipment, and approved explosion-proof, spark-proof or intrinsically safe equipment as necessary. Personnel entering the space shall be equipped with a harness and lifeline and a reliable attendant with an assistant shall be stationed outside the space to render assistance in the event of emergency. Communications between the person in the space and attendants outside the space shall be established and maintained.

(c) Personnel shall not enter spaces which contain flammable atmospheres above 10% of the LEL or toxic atmospheres which are IDLH except as authorized by paragraph 3-5a. NOTE: Certain types of spaces should not be entered when combustible gas and/or toxicity tests indicate any presence of flammable or toxic gases. Such spaces include those which contain, or previously contained, low flash point flammable or highly toxic materials such as gasoline tanks, chemical holding tanks, and similar spaces. In this regard, the CSEM must make a careful professional evaluation of all conditions prior to authorizing entry.

(d) Personnel shall not enter a space which contains oxygen enriched or deficient atmospheres. NOTE: Spaces with elevated or reduced pressure levels, regulated oxygen content, etc., such as hyperbaric chambers are excluded from coverage under the requirements of this regulation. Such operations shall be conducted in accordance with the appropriate governing regulations or documents.

b. Periodic and Continuous Testing.

(1) Many operations, due to the potential to generate hazardous conditions, require periodic or continuous monitoring as the work progresses to ensure that safe conditions are maintained. The frequency and types of testing to be conducted are dependent upon prevailing conditions and the nature of the operations. No single rule can be established for all operations and conditions. The CSEM shall establish the frequency and type of tests for periodic or continuous monitoring and these requirements shall be entered on SIOTY Form 48.

(2) When hazardous conditions are detected by periodic or continuous testing or by re-testing for certificate updating or when detected by any other means, all work shall be stopped immediately and personnel shall be removed from the space. The CSEM and the appropriate job supervisor shall be immediately notified of the conditions. Entry and work shall not be resumed until all unsafe conditions have been corrected or controlled, and the space has been re-tested and re-certified.

(3) The following types of operations shall be carefully evaluated for periodic or continuous monitoring.

(a) Hot work which has the potential of generating hazardous concentrations of contaminants or depleting oxygen.

(b) Hot work in the presence of preservatives, seepage of flammable from seams or rivets, and similar operations.

(c) Application of preservatives, paints, epoxies, etc., which may involve hazardous concentrations of toxic or flammable vapors.

(d) Cleaning operations, sludge removal, etc., which may produce or cause release of hazardous concentrations of toxic or flammable vapors.

(e) Any similar operations which possess the potential for producing or releasing toxic, flammable or asphyxiating atmospheres or materials into the space.

10-14. Certification of Confined Spaces. Upon completion of testing, inspection, evaluation, space cleaning and/or ventilation as appropriate, SIOTY Form 48 shall be issued. This permit shall indicate the conditions found to exist at the time the permit was issued, any requirements necessary to maintain the conditions within the space, and any requirements associated with the operations which are to be conducted within the space.

a. SIOTY Form 48. Confined Space Entry Permits are issued and distribution as follows:

(1) A copy shall be posted at the main entrance or most commonly used access to the space.

(2) A copy shall be retained for the Confined Space Entry Manager's files.

(3) A copy shall be provided to the Fire Department.

b. Category of Certification. The following categories of certification to indicate the conditions found at the time tests were conducted shall be utilized and noted on SIOTY Form 48. In order to provide

uniformity and to minimize any confusion or misunderstanding, only those categories listed herein and illustrated in Figure 2-1 shall be utilized for certification of confined or enclosed spaces.

(1) Not Safe For Personnel-Not Safe For Hot Work. This category shall be noted on the permit when:

(a) There is danger of toxic poisoning due to toxic materials, vapors or gases present or likely to be evolved under prevailing conditions, or danger of suffocation due to an oxygen deficiency.

(b) There is danger of fire or explosion due to the presence of flammable or explosive materials, vapors, or gases, or oxygen enrichment present or likely to be evolved under prevailing conditions.

(c) There is danger of fire, explosion, or toxic hazards in the presence of hot work due to the existence of flammable, explosive, or reactive residues, vapors, gases, or oxygen enrichment.

(d) There is a danger of fire, explosion, or toxic hazards in the presence of hot work due to boundary spaces which have not been protected as required.

(2) Not Safe For Personnel Without Protection-Not Safe For Hot Work Provisional. This category shall be noted on the permit when a provisional permit for entry is required for cleaning, etc., including conditions as follows:

(a) Toxic materials, vapors or gases may be present in the space or may be evolved, but at levels less than IDLH, and within the approved levels of prescribed respiratory protective devices and other personal protective equipment.

(b) Flammable vapors may be present or may be evolved but at levels less than 10% of the LEL, and controls can be installed to maintain levels below 10% of the LEL.

(c) There is danger of fire, explosion, or excessive toxic levels in the presence of hot work in the space, or from boundary spaces that have not been protected as required.

(d) Hot work is prohibited in the boundary spaces of the space for which a provisional permit is issued.

(e) Oxygen content is greater than sixteen percent but less than twenty percent.

(3) Safe For Personnel-Not Safe For Hot Work. This category shall be used on the permit for a space when:

(a) Toxic materials, vapors or gases are not present at significant levels or likely to be evolved by existing conditions, and oxygen content is sufficient (20% to 22%) and suitable for personnel; or such conditions are adequately and consistently controlled by ventilation.

(b) There is danger of fire or explosion or excessive

contaminants in the presence of hot work due to flammable or explosive materials, vapors or gases.

(c) There is danger of fire, explosion or excessive contaminants in the presence of hot work due to boundary spaces which have not been protected as required.

(4) Safe For Personnel-Safe For Hot Work. This category shall be utilized on the permit when:

(a) Toxic materials, vapors or gases are not present or likely to be evolved and oxygen levels are sufficient and suitable for personnel and/or such conditions are controlled by proper ventilation within established permissible exposure levels (PELs), and

(b) Flammable materials, vapors or gases have been removed, are not likely to be evolved and/or are controllable by ventilation, and

(c) Surrounding boundary spaces have been protected as required.

(5) Inerted-Not Safe For Personnel Inside-Safe For Hot Work Outside. This category shall be used on permits when:

(a) An inert medium has been introduced into the space in the required concentration to achieve a non-flammable atmosphere and will be maintained continuously to ensure proper inert atmospheres, or

(b) Oxygen content in the space will not support combustion or life, or

(c) Required measures have been taken to isolate the space and ensure isolation is maintained until the inerting medium is removed.

(4) Pressed-Up With-Not Safe For Personnel Inside-Safe For Hot Work Outside. This category shall be utilized when the space is pressed up to eliminate flammable atmospheres. The section on the permit for "Inerted" shall be checked and the words "Pressed-up With" along with the liquid used shall be entered in the blank space at the end of the inerted category. This category indicates that:

(a) The space has been entirely filled with liquid.

(b) Means have been provided to verify the liquid level and all air or vapor pockets have been eliminated.

(c) Boundary spaces have been protected as required.

10-15. Instrumentation.

a. The CSEM shall ensure that necessary instrumentation and equipment consistent with the nature of the operations and potential exposures are readily available in sufficient and properly maintained quantities to meet the minimum needs of the activity. As a minimum, instruments for conducting the following tests shall be available.

(1) Combustible atmospheres.

(2) Oxygen content.

(3) Toxic atmospheres - capability to test for known or potential exposures (e.g., carbon monoxide, carbon dioxide, hydrogen sulfide).

b. Approved Instruments. Where available, instruments which have been tested and approved by NIOSH and/or MSHA or formerly approved by the Bureau of Mines as appropriate, should be utilized for conducting confined space testing. All equipment that may be used in a flammable atmosphere shall be approved as explosion proof or intrinsically safe for the atmosphere involved by a recognized testing laboratory such as the U.S. Bureau of Mines, MESA, MSHA, Underwriters Laboratories.

c. Limitations of Instruments. Many instruments presently available for conducting required confined space testing have limitations which may effect the accuracy of the test results. Examples of such limitations include:

(1) Combustible gas indicators which function through a circuit imbalance created by the combustion of the sample inside the instrument will not function correctly in oxygen deficient or enriched atmospheres.

(2) Instruments are not necessarily designed and constructed to function correctly or safely in all classes of hazardous atmospheres. A combustible gas indicator designed for use only in a Class I Division I Group D atmosphere may be unsafe to use in the presence of Group A or B atmospheres such as acetylene or hydrogen.

(3) Certain contaminants present in the atmosphere may interfere with the function of the instrument and directly affect the instrument's accuracy. Therefore, readings must be adjusted to correct for the presence of such materials. Other materials may "poison" the sensors or filaments of the instrument and produce false readings or instrument failure.

(4) Changes in altitude or atmospheric pressure can affect the performance of certain instruments. Instruments shall ensure calibration under existing conditions.

(5) Confined space entry personnel shall be thoroughly trained in the instruments applicable to their operations and shall consult and observe manufacturers' instructions and directions regarding capability and limitations of the instruments.

d. Calibration and Maintenance. Instruments shall be maintained in good operating condition. Instruments which require calibration shall be calibrated in accordance with manufacturers instructions prior to each use. It is required that instruments be field calibrated immediately prior to and after each work shift in which the instruments are used. A record shall be maintained of all calibration checks. Where instruments fail to respond or respond incorrectly to known calibration conditions, the instrument shall be removed from service.

10-16. Personal Protective Clothing and Equipment.

a. Non-permeable outer clothing, gloves, boots, etc. shall be worn as

necessary when working with or when the space has contained a material which is irritating, corrosive, or toxic if absorbed through or comes in contact with the skin.

b. Suitable goggles or full coverage face shields with goggles shall be used as warranted to protect the face and eyes from irritating, highly corrosive, or toxic contaminants

c. Safety harnesses shall be tested yearly to 4,000 pounds. Lifelines must be approved material with a live-load limit equal to or greater than 1/2" or 3/4" rope of good quality and must be inspected periodically to ensure that they are free from defects. Lines shall be securely attached to the harness, checked prior to entry, and shall not be removed while inside the confined space. A winch shall be provided at the entrance. Provisions will be made to keep rope clean and dry. Positive steps will be taken to prevent chaffing.

d. Hard hats shall be worn upon entering confined spaces, when circumstances so warrant, and shall meet the requirements specified in 29 CFR 1910.135.

e. Respiratory Protection. Respiratory protection needs shall be determined by the Respirator Program Manager. The Industrial Hygienist shall be consulted as needed. Respiratory protection needs shall be based upon conditions and test results of the confined space and the work activity to be performed. Respirators shall be NIOSH/MSHA approved devices and shall be fitted, used, and maintained in accordance with 29 CFR 1910.134 and with Chapter 6. All personnel who may enter confined spaces shall have annual physical examinations to determine their ability to use respiratory protection devices and perform the work that may be required.

10-17. Breathing Air. Breathing air supplied to respiratory protective devices such as self-contained breathing apparatus, and supplied air respirator, shall as a minimum, meet the specification requirements for Grade D breathing air, as appropriate, as stated in 29 CFR 1910.134d. Air intakes for blowers, compressors, ventilation make-up air, etc., shall be located where vapors, exhaust gases, particulate matter, and other contaminants will not be drawn into the systems or into confined or enclosed spaces.

10-18. Spaces with Restricted Access and Hazardous Atmospheres. More than one means of access shall be provided in a confined or enclosed space which has a hazardous atmosphere, or where the work conducted within the space may generate a hazardous atmosphere, except where the structure or configuration of the space makes this impractical.

a. When the ventilation duct (non-breakaway type) blocks an access to a confined or enclosed space, which can be serviced by multiple accesses, at least two alternate means of access shall be immediately available. Where breakaway ducting is used, the access is not considered to be blocked.

b. When the space, due to its structure, arrangement or configuration, can have only a single access and the ventilation duct blocks or partially blocks the access, only breakaway ducting will be used. In addition, personnel working inside the space shall be equipped with NIOSH approved respiratory protection approved for the hazard and safety

belt and lifeline.

An attendant shall be stationed outside the space to render aid in an emergency. In addition, the emergency procedure requirements of paragraph 10-5 must be met.

10-19. Ventilation. Confined or enclosed spaces frequently contain atmospheres which are flammable, toxic, and/or oxygen depleted or enriched.

Natural ventilation is often insufficient to achieve an adequate interchange between the contaminated air inside the space and fresh air outside the space. This lack of air interchange is particularly true in confined spaces which have limited access openings. Ventilation provided by air-moving devices provides an effective means of removing contaminated air from a confined or enclosed space, introducing clean respirable air into a space, and of controlling the level of hazards created by contaminants in the space or evolved from operations conducted within the space.

10-20. Basic Ventilation Requirements. The objective of ventilation in confined or enclosed spaces is to:

a. Remove contaminated air (flammable or toxic) from the space and maintain safe levels of concentration in terms of Permissible Exposure Limits (PELS) or Lower Explosive Limits (LELs) as appropriate.

b. Provide fresh, respirable air in the space for breathing.

c. Capture and remove contaminants generated within the space, or dilute such contaminants to safe levels of concentration in terms of applicable PELs or LELs.

10-21. Ventilation for Entry and Work. Ventilation requirements for entry into, and work in, confined or enclosed spaces are dependent upon the nature of the space, the contents, and the operations to be conducted within the space. For purposes of confined space entry, requirements will be considered for general ventilation, dilution ventilation and local exhaust ventilation. Operations conducted within a confined or enclosed space may require the application of a single type of ventilation such as general ventilation, or may require the application of two types such as general ventilation combined with a local exhaust system.

a. General Ventilation. General ventilation may be utilized in a confined or enclosed space to provide uncontaminated respirable air for breathing, and to maintain general comfort of personnel. It may also suffice to maintain concentrations of toxic and flammable atmospheres to acceptable levels where the source of such contaminants are small and/or evolution of airborne contaminants is low. The accepted industry practice and the required level established by the Bureau of Medicine and Surgery for general ventilation is one complete air change every three minutes. Therefore, a 30,000 cubic foot space requires a general ventilation rate of 10,000 cubic feet per minute.

b. Dilution Ventilation. Dilution ventilation consists of introducing uncontaminated air into a space in order to dilute the contaminated air within the space to an acceptable level. Dilution ventilation is not as effective in contaminant control as local exhaust ventilation but may be required for certain types of

operations which cannot be effectively controlled with a local exhaust system. Dilution ventilation requirements may be calculated based on the generation rate of the contaminant, the specified level or percentage of LEL or PEL required to be achieved by dilution, and the applicable PEL or LEL of the contaminant involved. The provisions of "Industrial Ventilation," American Conference of Governmental Industrial Hygienists, shall be utilized in determining dilution ventilation requirements for operations conducted within confined or enclosed spaces.

c. Local Exhaust Ventilation. A local exhaust system consists of an arrangement where the air intake (duct opening or hood) is positioned close to the point of work where contaminants are generated. A local exhaust system captures the contaminants as they are generated, draws them into the duct work of the system and removes them from the work environment. Local exhaust systems are most effective in removing contaminants generated at one point, such as welding or localized solvent cleaning.

10-22. Ventilating Flammable Atmospheres. Fans, blowers, motors and other such equipment utilized to ventilate atmospheres which contain flammable or explosive vapors, fumes, mists, dusts, etc., shall be approved explosion-proof equipment or equipment which is intrinsically safe by design such as jet air movers, etc. Equipment shall be bonded and grounded as appropriate to control static electricity accumulation and discharges.

10-23. Ventilation System Arrangements. Ventilation systems should be arranged to provide the best possible distribution of air throughout the space and to provide clean, respirable make-up air to replace contaminated air removed from the space.

a. Air Circulation. The location of exhaust duct inlets and make-up air inlets is extremely important to achieving proper air distribution throughout a confined or enclosed space. Locating an exhaust fan in the top of a deep, single-opening confined space (where make-up air enters the space through the same opening in which the fan is located) will accomplish very little. Short circuiting will occur with the fan exhausting most of the make-up air which enters the space before it circulates through the space. The distribution of air in this case, can be greatly improved by extending a duct from the fan exhaust inlet to the bottom of the space. Air distribution and circulation can be vastly improved when make-up air and exhaust air move through separate openings in the space.

b. Make-up Air. Make-up air drawn into a space to replace contaminated air must be clean and contain sufficient oxygen levels for respiration. Make-up air inlets must not be located near exhaust outlets since this may result in contaminated exhaust air being re-circulated into the space. Where make-up air and exhaust air move through the same opening, ducting should be provided to carry exhaust air a sufficient distance away from the opening to prevent re-circulation of contaminated air.

c. Exhaust Outlets. Ventilation exhaust outlets which contain flammable or contaminants, shall be vented to the outside atmosphere in a location which will accommodate dilution and dispersal of the contaminants. Exhaust outlets shall not be placed in locations which will allow exhaust air to contaminate adjacent spaces, accumulate or pocket in low areas or expose personnel to harmful or dangerous atmospheres. Exhausted air shall

be discharged outdoors to the weather. Certain systems may require filtration of exhaust air prior to exhausting to the outside atmosphere. Such systems shall be fitted with the filtration or separation devices appropriate for the contaminant. Systems shall comply with appropriate state and/or federal environmental protection regulations.

d. Contaminants Lighter or Heavier Than Air.

(1) Contaminants which are lighter or heavier than air will tend to accumulate in the greatest concentration in the higher or lower areas, respectively, of a confined or enclosed space. A certain amount of diffusion may occur which will disperse the contamination in varying degrees of concentration throughout the space. However, the greatest and most dangerous concentrations will occur in the higher or lower portions of the space. Increased temperatures from heated processes or natural causes will increase evaporation and convection rates and cause vapors or gases to diffuse and rise to the upper portions of the space. Ventilation arrangements and the placement of exhaust and make-up air inlets should consider these characteristics.

(2) When contaminants which are heavier than air are present, exhaust outlets should be located near the bottom of the space with the make-up air inlet at the top of the space. When contaminants are lighter than air, or elevated temperatures are present, the system should be reversed with the exhaust outlet at the top of the space and make-up air inlet at the bottom of the space. These arrangements will allow the ventilation system to capture and remove the contaminants at expulsion of the hazardous atmospheres from the space through any and all openings which may be available. This may result in contamination of adjacent spaces and areas. Drawing air from the space may be less efficient from an air movement standpoint, but produces a controlled capture and removal process. Air may be blown into a space only when non flammable or toxic materials are present or are being generated by the work process, and ventilation is required only to provide clean, respirable air for breathing and general comfort.

10-24. Ventilation Requirements for Specific Operations. Ventilation requirements for certain operations are to be determined by the CSEM.

a. Determination as to the effectiveness of ventilation in reducing and maintaining safe levels of flammable, contaminants and provision of proper breathing air can only be achieved through proper sampling of the atmosphere within the space.

b. Compliance with specified minimum ventilation requirements does not, in itself, ensure that no flammable or toxic hazards will exist, due to the many variables which affect any given work situation. In many cases, it may be necessary to use ventilation in combination with approved respiratory protective devices. For example, dilution ventilation may be used to maintain flammable vapors at a concentration of 10% or less of the LEL. The ventilation provided may not be sufficient to dilute the contaminant to acceptable personnel exposure levels due to the fact that much higher volumes of air are normally required to dilute to PEL values. In such a case, ventilation may be used to control flammable vapor concentrations and approved respiratory protective devices used to protect personnel from toxic exposures.

c. Each work situation must be evaluated by competent, qualified personnel to ensure the ventilation provided is achieving the desired effect. Tests, measurements, samples and evaluations shall be performed by the CSEM, ACSEM, CSET or Industrial Hygienist as appropriate to the nature of the operation and contaminants.

d. Ventilation provided for any given operation is acceptable, even though it is less than the levels prescribed in this chapter, when it is demonstrated by test and evaluation that the ventilation provided is sufficient to maintain prescribed levels of clean respirable air and appropriate levels of LELs and PELs as applicable.

10-25. Definitions.

Assistant Confined Space Entry Manager (ACSEM): May be appointed by the Safety Manager to assist in the Entry Program.

Atmosphere mists: Refers to the gases, vapors, fumes and dusts within a confined space.

Ceiling Level concentration: The maximum airborne of a toxic agent to which an employee may be exposed for a specified period of time.

Combustible Dust: A dust capable of undergoing combustion or of burning when subjected to a source of ignition.

Confined Space: Spaces by design which have limited openings for entry and exit, poor natural ventilation, possibly containing dangerous air contamination or not enough oxygen to support life. Confined spaces may include, but are not limited to boilers, furnaces, degreasers, storage tanks, tanker trucks, tunnels, compartments, pits, vats, sewers, underground utility vaults, manholes, ventilation and exhaust ducts, silos, water towers, trenches, excavation, and cold storage facilities.

Confined Space, Class I : A confined space that has potential for causing injury or illness if preventive measures are not used. Included in this definition are any confined spaces where hazardous materials have been stored or generated, where any hot work is being conducted, where painting or other chemical operations are taking place, where internal operations could potentially cause bodily harm, or any space determined to be hazardous by a supervisor or Confined Space Entry Manager.

Confined Space, Class II: A confined space in which the only anticipated hazards are a potential lack of oxygen or a potential long term buildup of combustible gases, hydrogen sulfide, or methane due to infrequent entry. If any work is performed that may generate toxic air contaminants or present any unusual safety hazard, then the confined space automatically reverts to a Class I status.

Confined Space, Class III: A confined space or enclosed space which contains atmospheres or conditions which are, or may reasonably be expected to become, contaminated; but not to a level which is dangerous or immediately life threatening. Such conditions include the presence of flammable, or flammable atmospheres in concentrations less than 1% of the lower explosive limit (LEL), oxygen levels consistent with outside ambient conditions (20% or 21%), contaminants at concentrations below established PELs.

Confined Space, Class IV: A space which contains no flammables or contaminants, has an oxygen level between 20% to 21%, and presents little potential for generation of hazardous conditions as described in definitions Class I, Class II, or Class III above.

Confined Space Entry Manager (CSEM): The Safety Manager will be the Confined Space Entry Manager and will be responsible for the overall management of the Confined Space Entry Program.

Confined Space Entry Observer: A person trained in emergency rescue procedures and assigned to remain on the outside of the confined space and to be in communication with those working inside.

Confined Space Entry Technician (CSET): An individual appointed by a supervisor to conduct atmospheric monitoring. This individual shall be trained in the use of monitoring equipment and in the identification of hazardous atmospheres.

Contaminant: Any substance, dust, fume, mist, vapor, or gas, if present in the air, that can be harmful or hazardous to human beings.

Gas Free Engineer (GFE): Same as Confined Space Entry Manager.

Hot Work: Any work involving burning, welding, riveting, or similar fire producing operations, as well as work which produces a source of ignition, such as drilling, abrasive blasting, and space heating.

Immediately Dangerous to Life or Health (IDLH): Flammable or explosive vapors at or in excess of 10% of the LFL, oxygen less than 16% or more than 22%, or contaminants exceeding a level from which a person could escape without impairing symptoms or irreversible health effects.

Inerting: Displacement of the atmosphere by a non-reactive gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

Isolation: A process whereby the confined space is removed from service and completely protected against the inadvertent release of material by the following: blanking off (skillet-type metal blank between flanges), mis-aligning sections of all lines and pipes, a double block and bleed system, electrical lockout of all sources of power, and blocking or disconnecting all mechanical linkages.

Lower Explosive Limit (LEL): The minimum concentration of a combustible gas or vapor in air (usually expressed in percent by volume at sea level), which will ignite if an ignition source (sufficient ignition energy) is present.

Observer: A person trained in emergency rescue procedures and assigned to remain on the outside of the confined space and to be in communication with those working inside.

Oxygen Deficiency: Refers to an atmosphere with less than 20% oxygen. Normal air at sea level contains approximately 21% oxygen.

Oxygen Enriched Atmosphere: Any oxygen concentration greater

than 22% (PO₂ - 190 mm Hg) at normal atmospheric pressure.

Permissible Exposure Limit (PEL): The maximum 8-hour time weighted average of any airborne contaminant to which an employee may be exposed. At no time shall the exposure level exceed the ceiling concentration for that contaminant as listed in 29 CFR Part 1910 Sub Part Z.

Pressing Up: Means of eliminating flammable vapor-air mixtures from a space by completely filling the space with a liquid.

Purging: The method by which gases, vapors or other airborne impurities are displaced from a confined space.

Qualified Person: A person designated by the employer, in writing, as capable (by education and/or specialized training) of anticipating, recognizing, and evaluating employee exposure to hazardous substances or other unsafe conditions in a confined space. This person shall be capable of specifying necessary control and/or protective action to ensure worker safety.

Respirator (Approved): A device which has met the requirements of 29 CFR 1910.134 and is designed to protect the wearer from inhalation of harmful atmospheres and has been approved by the Respirator Program Manager.